CLAIMS:

1. A field emission device for a visual display comprising:

- a substrate having at least a front substrate layer and
- an emission layer on a front face of the substrate, the emission layer having:
  - a multiplicity of emitters and gates, arranged as an array of emission pixels and
  - conductive connections in the emission layer to the emitters and the gates, the conductive connections including:
    - emitter lines at the front face of the substrate;
- the substrate having:
  - conductive vias provided through the substrate or at least a front layer thereof to at least some of the said conductive connections in the emission layer for electrical connection to their emitters and gates;

characterised in that the field effect emission device further comprises:

- grooves provided in the front surface of the substrate, the emitter lines being formed in the grooves.

2. A field emission device according to claim 1, wherein the front substrate layer is of ceramic and the grooves are formed by serration of a tape-casting, doctor blade.

3. A field emission device according to claim 1, wherein the front substrate layer is of ceramic and the grooves are formed by laser cutting

4. A field emission device according to claim 1, wherein the front substrate layer is of ceramic and the grooves are formed by chemical etching.

5. A field emission device according to claim 4, wherein the grooves are shallow, being of the order of 1/10 of 1% of the thickness of the front layer, the front layer being between 0.005" and 0.010" thick.

6. A field emission device according to claim 4, wherein the grooves are shallow, being of the order of 4/100 of 1% of the thickness of the front layer, the front layer being between 0.020" and 0.040" thick.

7. A field emission device according to claim 1, wherein the emitter lines are of metal deposited by sputtering.

8. A field emission device according to claim 1, wherein the emitter lines are of metal deposited by vacuum deposition.

9. A field emission device according to claim 1, wherein the emitter lines metal is molybdenum.

10. A field emission device according to claim 9, wherein the emitter lines are of metal deposited by sputtering and to enhance adherence of the sputtered molybdenum lines in the grooves, a preliminary sputtered coating of another metal having a good adherence to ceramic is laid down.

11. A field emission device according to claim 1, wherein the emitter lines are a fired slurry deposition

12. A field emission device according to claim 1, wherein at least the vias in the front layer of the substrate are filled with a via material formed of or including a material which expands by reaction on firing of the substrate.

13. A field emission device according to claim 12, wherein the via fill material is or comprises a metal which expands by oxidation on firing of the substrate.

14. A field emission device according to claim 12, wherein via fill material is a ruthenium containing paste.

15. A field emission device according to claim 12, the expansible material is bulked with other material which is inert to the reaction causing expansion

16. A field emission device according to claim 15, wherein bulking material is a precious metal or a ceramic material.

17. A field emission device as claim in claim 1, wherein the substrate is a multilayer substrate having a front substrate layer and at least one additional substrate layer, with conductive vias provided through the front layer and the or each additional layer and with electrical interconnection tracks at at least some of the interface(s) between adjacent layers so arranged that a front layer via is offset from a via in a back one of the additional layer(s) to which it is electrically connected by the interconnection tracks, the back one of the additional layers being provided with a connection arrangement.

18. A field emission device according to claim 17, in combination with a back plate with a plurality of layers to provide fan-out to driver chip(s), the substrate and the back plate being connected by the connection arrangement.

19. A field emission device according to claim 1, wherein the substrate is comprised of or includes two layers with vias in one aligned with vias in the next.

20 A field emission device according to claim 1, the substrate is a single layer of ceramic having the grooves in the front surface and vias straight through to a connection arrangement at a back face of the substrate.

21. A field emission device according to claim 19, in combination with a back plate with a plurality of layers to provide fan-out to driver chip(s), the substrate and the back plate being connected by the connection arrangement.

22. A field emission device according to claim 1, wherein the substrate comprises:

- a plurality of thin, ceramic layers and
- a thicker, foundation, ceramic layer

23. A field emission device according to claim 22, wherein the foundation layer is between 3 and 10 times thicker than the thin layers.

24. A field emission device according to claim 23, wherein the foundation layer is between 0.015" and 0.100" thick and the thin layers are between 0.005" and 0.010" thick.

25. A field emission device according to claim 24, wherein the foundation layer is between 0.020" and 0.030" thick.

26. A field emission device according to claim 22, in combination with a back plate having a thick foundation layer and a plurality of thin layers to provide fan-out to driver chip(s), the substrate and the back plate being connected by the connection arrangement.

27. A method of providing emitter lines in a field emission device for a visual display, the field emission device having:

a substrate having at least a front substrate layer and

an emission layer on a front face of the substrate, the emission layer having,

a multiplicity of emitters and gates, arranged as an array of emission pixels and

conductive connections in the emission layer to the emitters and the gates, the conductive connections including:

emitter lines at the front face of the substrate;

the substrate having,

conductive vias provided through the substrate or at least a front layer thereof to at least some of the said conductive connections in the emission layer for electrical connection to their emitters and gates;

the method being characterised by the steps of,

- forming grooves in the front surface of the substrate, and
- filling the grooves to provide the emitter lines.

28. A method of providing emitter lines according to claim 27, wherein the front substrate layer is of ceramic and the method includes the step of

- forming the grooves by tape casting the front layer of the substrate using a serrated a tape-casting, doctor blade, the grooves being formed by the serrated blade.

29. A method of providing emitter lines according to claim 27, wherein the front substrate layer is of ceramic

- forming the grooves by laser cutting.

30. A method of providing emitter lines according to claim 27, wherein the front substrate layer is of ceramic and the method includes the step of,

- the grooves are formed by chemical etching.

31. A method of providing emitter lines according to claim 30, wherein the grooves are shallow, being of the order of 1/10 of 1% of the thickness of the front layer, the front layer being between 0.005" and 0.010" thick.

32. A method of providing emitter lines according to claim 30, wherein the grooves are shallow, being of the order of 4/10 of 1% of the thickness of the front layer, the front layer being between 0.020" and 0.040" thick.

33. A method of providing emitter lines according to claim 27, wherein the emitter lines are of metal deposited by sputtering.

34. A method of providing emitter lines according to claim 27, wherein the emitter lines are of metal deposited by vacuum deposition.

35. A method of providing emitter lines according to claim 33, wherein the emitter lines metal is molybdenum

36. A method of providing emitter lines according to claim 35, wherein the emitter lines are of metal deposited by sputtering and including the step of a preliminary sputtering of a metal having a good adherence to ceramic, to enhance adherence of the molybdenum lines in the grooves.

37. A method of providing emitter lines according to claim 27, wherein the emitter lines are deposited as a slurry which is subsequently fired.

38. A method of providing emitter lines according to claim 37, wherein the slurry deposition is by a resinate process, the fired deposition being of the order of 10 thousandths of an inch thick.

39. A method of providing emitter lines according to claim 38, wherein the fired deposition is polished back to the substrate material of the front layer after firing, to provide a suitable surface for the production of emitter tips thereon.

40. A method of providing emitter lines according to claim 27, in combination with the steps of filling of vias in the front layer of the substrate by screen printing of via material and of subsequently firing the front layer, after slurry deposition of the emitter lines if appropriate.

41. A combined method according to claim 40, including application of vacuum in a register plate having vacuum passages aligned with the vias for drawing the via material through the vias.

42. A method of providing emitter lines according to claim 27, in combination with the steps of filling of vias in the front layer of the substrate by forcing via material under pressure through a mask having apertures aligned with the vias to be filled and of subsequently firing the front layer, after slurry deposition of the emitter lines if appropriate.

43. A combined method according to claim 27, in combination with the steps of filling of vias in the front layer of the substrate and wherein the emitter lines are deposited as a slurry, and the via material and the slurry deposited material are fired together.

44. A combined method according to claim 43, wherein the via and line metallic materials are both of molybdenum, the firing being at high temperature of the order of 1400°C in a hydrogen atmosphere.

45. A combined method according to claim 27, in combination with the steps of filling of vias in the front layer of the substrate and wherein the via fill material expands by reaction on firing.

46. A combined method according to claim 45, wherein the firing is performed in an oxidising atmosphere, the via fill material being comprised of or including an oxidisable metal.

47. A combined method according to claim 27, in combination with the steps of filling of vias in the front layer of the substrate and including the step of laminating the front ceramic layer alone, or a lay up of a plurality of ceramic layers including the

front ceramic layer, and/or one or more rear layers in the unfired/green state to a thicker foundation layer of fired ceramic.

48. A combined method according to claim 47, including the step of laser drilling and filling of via apertures in the foundation layer after its first firing and prior to lamination thereto.

49 A combined method according to claim 47, including the step of polishing the front face of the foundation layer prior to lamination of green layers thereto.

50. A combined method according to claim 47, wherein the thin layers are tape cast onto a plastics material backing.

51 A combined method according to claim 50, wherein the via apertures are punched and filled with via material whilst the layer is supported on the plastics material backing

52. A combined method according to claim 51, wherein the interconnection tracks are screen printed onto the layers whilst still green.

53. An electronic component to have an electrical component incorporated thereon, the electronic component comprising:

- a substrate having
    - at least a front substrate layer with a front face for receiving the electrical component and
    - conductive vias provided through the substrate or at least a front layer thereof to electrical connection to the electrical component;

characterised in that the electronic component further comprises:

- grooves provided in the front surface of the substrate, the conductive lines being formed in the grooves for electrical connection to the electrical component.

54. An electronic component according to claim 53, wherein the front substrate layer is of ceramic and the grooves are formed by serration of a tape-casting, doctor blade.

55 An electronic component according to claim 53, wherein the front substrate layer is of ceramic and the grooves are formed by laser cutting.

56. An electronic component according to claim 53, wherein the front substrate layer is of ceramic and the grooves are formed by chemical etching.

57. An electronic component according to claim 52, wherein the conductive lines are of metal deposited by sputtering.

58. An electronic component according to claim 52, wherein the conductive lines are of metal deposited by vacuum deposition.

59. An electronic component according to claim 52, wherein the conductive lines are a fired slurry deposition.

60. An electronic component comprising:

- a substrate having
  - at least two substrate layers,
  - conductive tracks at interfaces and
  - conductive vias provided through the substrate layers and connecting with respective ones of the conductive interface tracks to provide electrical connection from one side of the substrate to the other,

characterised in that the electronic component further comprises.

- grooves for the conductive tracks provided in a surface of one or more of the substrate layers, the conductive tracks being formed in the grooves.

61. An electronic component according to claim 60, wherein the substrate layers are of ceramic and the grooves are formed by serration of a tape-casting, doctor blade.

62. An electronic component according to claim 60, wherein the substrate layers are of ceramic and the grooves are formed by laser cutting.

63. An electronic component according to claim 60, wherein the substrate layers are of ceramic and the grooves are formed by chemical etching.

64. An electronic component according to claim 60, wherein the conductive tracks are of metal deposited by sputtering.

65. An electronic component according to claim 60, wherein the conductive tracks are of metal deposited by vacuum deposition.

66. An electronic component according to claim 60, wherein the conductive tracks are a fired slurry deposition

67. An electronic component to have an electrical component incorporated thereon, the electronic component comprising:

- a substrate having
  - at least a front substrate layer with a front face for receiving the electrical component and

- via apertures through the substrate or at least a front layer thereof and filled with via material to provide electrical connection to the electrical component;

characterised in that,

- the via material is formed of or includes a material which expands by reaction on firing of the substrate.

68. An electronic component according to claim 67, wherein the via fill material is a metal which expands by oxidation on firing of the substrate.

69. An electronic component according to claim 67, wherein via fill material is a ruthenium containing paste.

70. An electronic component according to claim 67, the expansible material is bulked with other material which is inert to the reaction causing expansion.

71 An electronic component according to claim 70, wherein bulking material is a precious metal or a ceramic material

72. An electronic component comprising:

- a substrate having
  - at least two substrate layers,
  - conductive tracks at interfaces and
  - via apertures through the substrate layers and filled with via material to provide electrical connection with respective ones of the conductive interface tracks to provide electrical connection from one side of the substrate to the other,

characterised in that:

- the via material is formed of or includes a material which expands by reaction on firing of the substrate.

73. An electronic component according to claim 72, wherein the via fill material is a metal which expands by oxidation on firing of the substrate.

74. An electronic component according to claim 72, wherein via fill material is a ruthenium containing paste.

75. An electronic component according to claim 72, the expansible material is bulked with other material which is inert to the reaction causing expansion.

76. An electronic component according to claim 75, wherein bulking material is a precious metal or a ceramic material.

77. An electronic component to have an electrical component incorporated thereon, the electronic component comprising:

- a substrate having
  - a front substrate layer with a front face for receiving the electrical component,
  - at least one further substrate layer and
  - via and interconnect arrangement for providing electrical connection to the electrical component, the electrical connection being distributed across the front face,

characterised in that the substrate layers comprise:

- at least one thin, ceramic layer and
- a thicker, foundation, ceramic layer, the thin layer(s) having been laminated in green state to the thick layer which has previously been fired, the substrate being fired after lamination.

78 An electronic component according to claim 77, wherein the foundation layer is between 3 and 10 times thicker than the thin layers.

79. An electronic component according to claim 78, wherein the foundation layer is between 0.015" and 0.100" thick and the thin layers are between 0.005" and 0.010" thick.

80. An electronic component according to claim 79, wherein the foundation layer is between 0.020" and 0.030" thick

81. An electronic component comprising a multilayer substrate having a plurality of vias and interconnects for providing electrical connection between one set of electrical features on one face and another set of electrical features on the other face thereof, the two sets of electrical features being differently arranged on the two faces, the substrate having

- a lateral extension formed integrally with the substrate and carrying a third set of electrical features, the third set being contacts connected one to one to the second set, whereby the component can be tested via the third set of contacts and
- a fracture line in the substrate at a juncture of the lateral extension to the substrate for removing the extension and the third set of contacts by fracture along the line after testing.

82. A via fill material for filling via apertures in a substrate of an electronic component, the material formed of or including a material which expands by reaction on firing of the substrate.

83. A field emission device as claimed in claim 82, wherein the via fill material is a metal which expands by oxidation on firing of the substrate.

84. A field emission device as claimed in claim 82, wherein via fill material is a ruthenium containing paste.

85. A field emission device as claimed in claim 82, the expansible material is bulked with other material which is inert to the reaction causing expansion.

86. A field emission device as claimed in claim 85, wherein bulking material is a precious metal or a ceramic material.